F/V EASTWARD HO Assemblage Survey of Hecate Strait, May 27-June 16, 1987

J. Fargo, R. P. Foucher, M. W. Saunders, A.V. Tyler, and P.L. Summers

Department of Fisheries and Oceans
Fisheries Research Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

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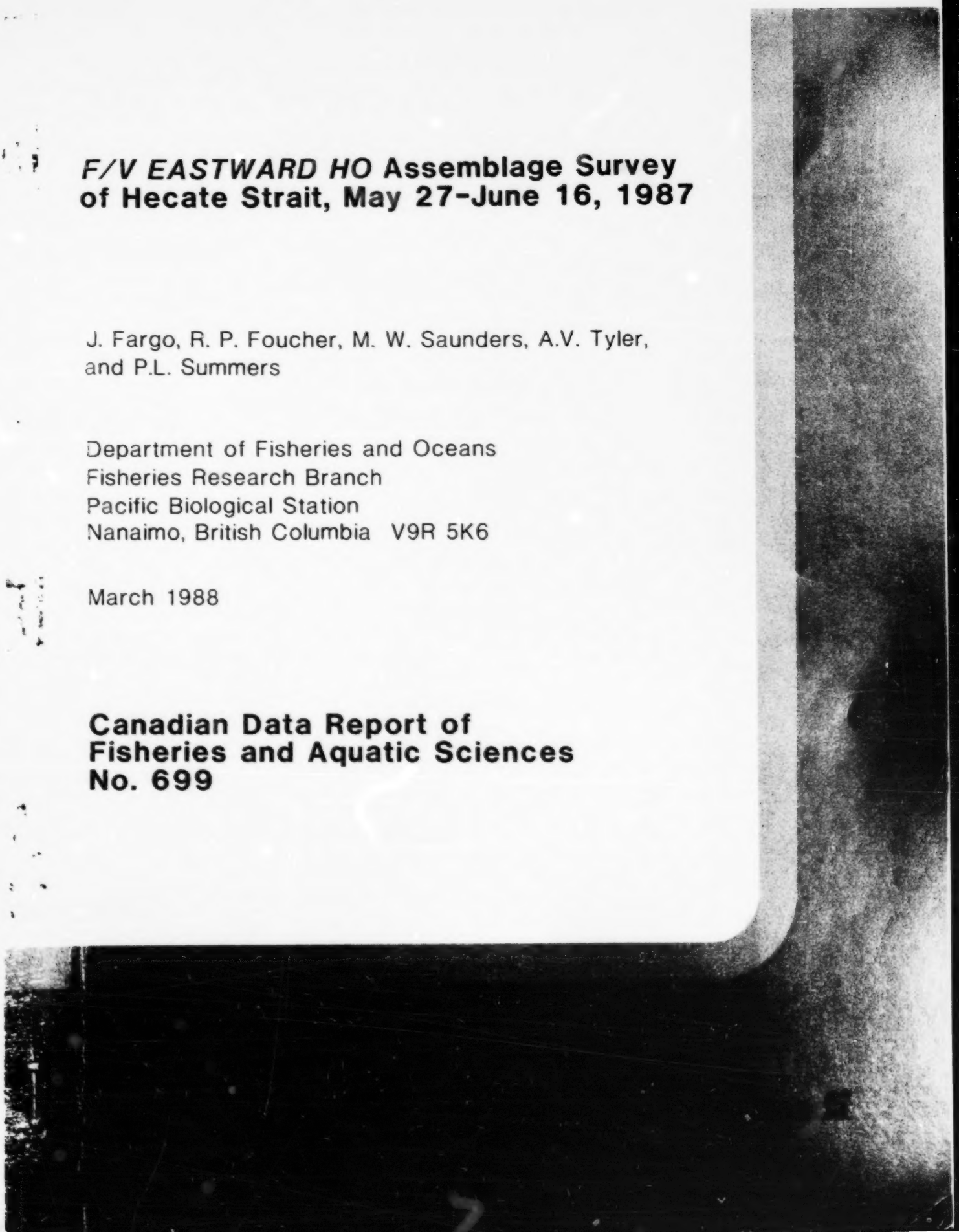

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Les numéros 1 à 25 de cette série ont été publiés à titre de Records statistiques, Service des pêches et de la mer. Les numéros 26-160 ont été publiés à titre de Rapports statistiques du Service des pêches et de la mer, Ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 161.

Le titre exact paraît au haut du résumé de chaque rapport.

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F/V EASTWARD HO ASSEMBLAGE SURVEY OF HECATE STRAIT, MAY 27-JUNE 16, 1987

by

J. Fargo, R. P. Foucher, M. W. Saunders, A. V. Tyler, and P. L. Summers

Department of Fisheries and Oceans

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ABSTRACT

Fargo, J., R. P. Foucher, M. W. Saunders, A. V. Tyler, and P. L. Summers. 1988. F/V EASTWARD HO assemblage survey of Hecate Strait, May 27-June 16, 1987. Can. Data Rep. Fish. Aquat. Sci. 699: 172 p.

During May-June 1987, the F/V EASTWARD HO completed a synoptic trawl survey of groundfish species occupying the shelf area (10-129 fath; 18-236 m) of Hecate Strait. Previous surveys of this nature have been conducted in May-June 1984 and February 1986. The purpose of these surveys is to collect information on species assemblages in the region in the form of species catch composition data. This is the first step towards development of an ecological basis for mixed-species stock assessment. This report contains the results of the survey regarding weight and number for species caught and length-frequencies by haul (90 usable). A summary of ovary samples collected for a study of the reproductive biology of Pacific cod and English sole is also included.

Key words: groundfish, species assemblages, mixed species stock assessment, Hecate Strait

RESUME

Fargo, J., R. P. Foucher, M. W. Saunders, A. V. Tyler, and P. L. Summers. 1988. F/V EASTWARD HO assemblage survey of Hecate Strait, May 27-June 16, 1987. Can. Data Rep. Fish. Aquat. Sci. 699: 172 p.

En mai et juin 1987, le personnel du EASTWARD HO a effectué un relevé synoptique au chalut des espèces de poissons démersaux fréquentant la plateforme (10-129 brasses; 18-236 m) du détroit d'Hécate. Des relevés du même type ont été réalisés en mai-juin 1984 et en février 1986. Ils sont axés vers la cueillette d'information sur les assemblages de poissons dans la région sous la forme de données sur la composition des prises par espèce. Ceci constitue la première étape de l'élaboration d'une base de données écologiques pour l'évaluation de stocks polyspécifiques. Le présent rapport contient les résultats du relevé, soit le poids et le nombre de poissons capturés selon l'espèce et les fréquences de longueurs par trait (dont 90 étaient utilisables). On présente aussi un résumé des données sur les ovaires recueillis en vue d'une étude du cycle reproducteur de la morue du Pacifique et de la sole anglaise.

Mots-clés: poissons démersaux, assemblages spécifiques, évaluation de stocks polyspécifiques, détroit d'Hécate

INTRODUCTION

This work was carried out as part of the Pacific Biological Station's Hecate Strait Project. The purpose of the project is to develop an ecological basis for alternative, mixed-species stock assessment techniques. Species catch composition data from several synoptic surveys has been used to map on-bottom fish assemblages in Hecate Strait. Surveys conducted in different years and at different times of the year are being used to examine inter-annual and inter-seasonal variability within assemblages.

In addition, stomach sampling was conducted as part of the food-resource division sub-project of the Hecate Strait project. The aim of this work is to detect patterns of food-resource division among abundant groundfish species within each of the major assemblages.

The first two surveys were conducted as joint operations with a fisheries research vessel (Fargo et al. 1984; Westrheim et al. 1984; Fargo and Davenport 1986; and Foucher et al. in prep.). Previous stomach sampling cruises are reported in Saunders et al. (1986).

MATERIALS AND METHODS

FISHING VESSEL

The F/V EASTWARD HO, a 32.6 m (overall length) steel stern trawler, was the vessel chartered for the survey.

FISHING GEAR

Fishing gear consisted of a Yankee 36 trawl net (Fig. 1) connected to the vessel's 1900-lb (899 kg) steel doors. Two different groundlines were used during the survey, for "hard bottom" tows at depths > 80 fath in Moresby Gully a bobbin groundline consisting of five 14-inch steel bobbins with 6-inch rubber spacers between for the bosom section and five 14-inch rubber half eggs with 6-inch rubber spacers between for the wing sections. For depths < 80 fath in Hecate Strait a conventional groundline consisting of 7-inch rubber discs on 5/8 x 6 x 19 steel cable was used. The net used in Moresby Gully had 3½-inch mesh in the wings and body and 1-inch mesh in the codend while the net used in Hecate Strait had 5½-inch mesh in the wings and body and 1-inch mesh in the codend.

SURVEY DESIGN

The design for this survey was somewhat different from the two previous two-vessel surveys. This was because only about 60% of the effort utilized on the previous summer survey was possible on this survey, employing only a single vessel.

The stations selected for this survey were selected to allow proportionate sampling of all species assemblages previously encountered. Stations which had been repeated by both vessels in previous surveys amounted to a single trawl haul in this survey. Stations which were important in determining the boundaries of assemblages were retained.

CATCH PROCESSING

Each trawl catch was segregated by species into plastic containers (ca. 50-kg capacity), hereafter referred to as "tubs". The weight of each tub was obtained to the nearest kg with a metal platform deck balance. The total weight for each species caught was equal to the sum of the sorted tub weights for the species in the catch.

LENGTH FREQUENCIES

Fork length was recorded to the nearest centimeter for most of the specimens caught, except spiny dogfish which were measured total length, with the tail bent down in line with the body, and ratfish which were measured to the posterior edge of the third dorsal fin. To expedite measuring and recording fork lengths of moderate to large catches, the plastic-strip method (Davenport and Harling 1965) was employed. For dogfish, sex was also recorded based on external characteristics. Exceptions to measuring all specimens caught involved a) large catches of individual species and b) species not measured due to oversight. Usually, this involved species constituting a trace (less than 1% of the total weight) amount in a haul.

For large catches (ca. $\geq$ 300 specimens) of individual species, sampling schemes were employed to reduce catch-processing time. Most schemes followed, or were modifications of, that reported by Westrheim (1967).

OVARY SAMPLES

Ovaries were collected from Pacific cod and English sole as time allowed during the cruise. These samples were to be used for a histological study of the reproductive biology of these two species. The method of

collection is detailed in Tyler et al. 1987. Briefly, in the case of Pacific cod both ovaries were removed, while for English sole only the right ovary was removed. A length-stratification procedure was used for immature and mature fish to ensure that samples were spread throughout the length range of each species. The ovaries were preserved in buffered formal saline for later processing.

STOMACH SAMPLES

Stomachs from fish collected in four trophic sampling areas (see Saunders et al. 1986) were preserved for detailed laboratory analysis. Stratified samples of 10 stomachs, containing food, per 10-cm length interval for each species were taken. Stomachs were removed from the fish by cutting the esophagus as close as possible to the mouth and by cutting the intestine just posterior to the stomach. The stomachs were sealed in individual plastic bags (Whirlpak) with 10% buffered formalin in sea water. A label giving the cruise, haul, species, and the fish's length was also included. Records of individual fish lengths and the incidence of empty stomachs were kept. In the case of ratfish, the entire gut was preserved because of the short and poorly defined stomach.

RESULTS

A total of 96 trawl hauls were completed, of which 90 were deemed "usable" (Fig. 2). The six "unusable" hauls were disqualified due to snags (3) or short duration (3) (Table 1).

Total fish catch from usable hauls was 30,020 kg (56,398 specimens), comprising 49 species (Table 2). Principal species by weight were arrowtooth flounder, spiny dogfish, Pacific cod, S. alutus, and English sole -- 67% of the total catch. Principal species by number were English sole, arrowtooth flounder, Pacific ocean perch, eulachon, and rex sole -- 66% of the total catch.

Detailed records of all trawl hauls, and catch weights by species, are contained in Appendix table 1. An index to common and scientific names of all fish species caught is contained in Appendix table 2.

TRAWLING SCHEME

The F/V EASTWARD HO was assigned 89 trawling stations from A2 to L6 (Fig. 1; Table 3). A total of 86 stations were completed successfully, two stations (B201, B306) were eliminated due to bad bottom (snags), and one

station (C304) was eliminated inadvertently. Also, two stations (B205, I404) were repeated during the course of collecting stomach data, two stations (G303, J202) were repeated due to bad bottom and short tows, one station (L610) was duplicated due to a snag, and replicates were performed at two stations (B205 and F405).

LENGTH FREQUENCIES

Fork (or total) lengths (cm) were recorded for 32,691 specimens (est. 56,398 caught). Catch-sampling occurred for one or more species in 16 hauls, and computations of total numbers caught are shown in Table 5, together with method of sampling.

In several instances, species were sorted and weighed, but not measured or counted. Table 6 lists estimates of the total number of such species caught. These estimates were derived using the following equation:

$$n = \frac{Nw}{W}$$ where,

n = number of a given species weighed but not measured.
N = number of a given species measured for the survey.
w = weight of a given species not measured.
W = weight of a given species measured for the survey.

Table 2 contains an index to Appendix tables containing length-frequency data (or individual length) records, by haul, for each species, as well as a record of the weights (kg) and numbers of individual species caught for usable hauls on the cruise.

OVARY SAMPLES

Ovaries were collected from 65 Pacific cod, with 28 immature fish and 37 mature fish being sampled. Ovaries were obtained from 79 English sole, with 16 immature and 63 mature fish being sampled. Length frequencies for the ovary samples for immature and mature specimens of both species are summarized in Table 6. Pacific cod ovaries were obtained from fish over a length range of 33-75 cm. The range of lengths for English sole sampled for ovaries was 21-53 cm.

STOMACH SAMPLES

Stomachs were collected from 605 fish. The numbers of stomachs collected by species and haul are listed in Table 7. Length frequencies of

fish with stomachs containing food, with empty stomachs and with everted stomachs are presented by species and haul, in Appendix tables 3, 4 and 5 respectively.

PERSONNEL

J. Fargo (i/c)	Pacific Biological Station	May 27-June 16
R. Foucher	"	"
P. Summers	"	May 27-June 16
M. Saunders	"	May 27-June 5
A. Tyler	"	June 6-June 16

ACKNOWLEDGMENTS

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Table 1. Unusable trawls, by location and cause, of the F/V EASTWARD HO assemblage survey, May 27-June 16, 1987.

Haul no.	Block-strata	Cause
1	L610	snag, net torn
43	J202	tow too short
68	B201	snag, net torn
77	B306	snag, net torn
85	G303	tow too short
86	G303	tow too short

Table 2. Total weight (kg) and numbers, by species, of fish specimens caught in usable hauls during F/V EASTWARD HO assemblage survey, May 27-June 16, 1987. (See appropriate page numbers for length frequencies).

Flatfish	Weight (kg)	Numbers	Page number
Arrowtooth flounder	7,590	7,462	67,75,84
Butter sole	35	300	91
Curlfin sole	4	16	92
Dover sole	1,556	3,040	68,76,93
English sole	2,297	10,977	68,76,97
Flathead sole	129	672	69,76,101
Pacific halibut	789	204	69,76,103
Pacific sanddab	285	1,843	69,77,105,117
Petrale sole	41	85	69,77,107
Rex sole	958	5,615	70,109
Rock sole	635	1,372	70,77,112
Sand sole	30	76	70,77,115
Slender sole	11	111	116
Starry flounder	7	9	117
Sub-total	14,367	31,782	

Other roundfish	Weight (kg)	Numbers	Page number
Chinook salmon	3	1	130
Eulachon	170	6,286	79,131
Greenlings	6	15	131
Lingcod	425	154	71,79,132
Pacific cod	3,405	3,759	72,80,136
Pacific hake	1	1	142
Pacific herring	1	16	142
Sandlance	3	251	146
Sablefish	216	13	72,80,143
Walleye pollock	591	126	72,81,147
Wolfeel	5	1	150
Sub-total	4,826	10,623	

Rockfish	Weight (kg)	Numbers	Page number
S. aleutianus	4	8	118
S. alutus	2,748	7,056	71,78,82,119
S. babcocki	374	219	71,78,82,120
S. brevispinis	743	332	71,78,82,121
S. caurinus	19	13	122
S. entomelas	4	9	123
S. flavidus	376	649	71,78,83,124
S. maliger	113	92	125
S. paucispinis	246	49	79,83,126
S. pinniger	26	44	79,127
S. proriger	5	41	128
S. ruberrimus	5	1	128
Seb. alascanus	30	117	129
Sub-total	4,693	8,630	

Selachii	Weight (kg)	Numbers	Page number
Ratfish	1,281	3,302	73,151
Skate — big	497	33	73,155
Skate — black	9	17	73,155
Skate — longnose	12	5	155
Spiny dogfish	4,143	2,007	73,74,81,157
Sub-total	5,934	5,364	
Grand Totals	30,020	56,398	

Table 3. Inventory of scheduled trawl hauls by the F/V EASTWARD HO, by block and depth strata, May 28-June 16, 1987.

	Depth Strata										
Block	1	2	3	4	5	6	7	8	9	10	Total
A-2						*					1
A-3			*	*		*					3
B-1					*	*	*				3
B-2	*	*	*	*	*		*				6
B-3	*	*	*	*		*					5
C-2	*										1
C-3	*	*	*	*	*						5
D-3	*	*	*	*							4
D-4				*							1
E-2	*	*									2
E-3		*	*								2
E-4		*			*		*				3
E-5					*						1
F-2	*										1
F-3		*	*								2
F-4			*	*	*		*				4
G-3	*		*		*						3
G-4				*	*		*				3
H-2	*										1
H-3	*	*	*	*							4
H-4					*	*	*				3
I-2	*										1
I-3	*		*								2
I-4	*	*	*	*	*		*				6
I-5				*		*	*	*			4
J-2		*									1
J-3	*										1
J-4	*	*		*							3
J-5					*	*					2
J-6									*		1
K-4				*	*	*					3
K-5						*					1
K-6								*	*		2
L-4						*	*				2
L-5							*				1
L-6										*	1
Total											89

Table 4. Inventory of hauls, by block and depth strata, completed by the F/V EASTWARD HO, May 27-June 16, 1987.

Block-strata	Haul	Block-strata	Haul	Block-strata	Haul
A2-6	70	F2-1	14,15	J2-2	43,96
A3-3	72	F3-2	12	J3-1	42
A3-4	71	F3-3	13	J4-1	41
A3-6	73	F4-3	10	J4-2	39
		F4-4	9	J4-4	40
B1-5	63	F4-5	8,11	J5-5	38
B1-6	62	F4-7	7	J5-6	36
B1-7	61			J6-9	5
B2-1	68	G3-1	16		
B2-2	66	G3-3	85,86,87	K4-4	22
B2-3	67	G3-5	88	K4-5	21
B2-5	60,64,65	G4-4	83	K4-6	20
B2-7	69	G4-5	84	K5-6	35
B3-1	78	G4-7	89	K6-8	3
B3-2	75			K6-9	4
B3-3	74	H2-1	95	L4-6	18
B3-4	76	H3-1	94	L4-7	17
B3-6	77	H3-2	93	L5-7	19
		H3-3	92	L6-10	1,2
C2-1	79	H3-4	91		
C3-1	59	H4-5	90		
C3-2	80	H4-6	44		
C3-3	81	H4-7	45		
C3-5	82				
		I2-1	23		
D3-1	58	I3-1	24		
D3-2	57	I3-3	25		
D3-3	56	I4-1	28		
D3-4	55	I4-2	27		
D4-4	54	I4-3	26		
		I4-4	33,34		
E2-1	53	I4-5	29		
E2-2	52	I4-7	32		
E3-2	51	I5-4	37		
E3-3	50	I5-6	30		
E4-2	48	I5-7	31		
E4-5	49	I5-8	6		
E4-7	47				
E5-5	46				

Table 5. Calculated numbers of specimens, by species, caught for hauls in which all specimens caught were not enumerated or measured during F/V Eastward Ho assemblage survey May 27-June 16, 1987.

Haul no.	Species	Weight (kg)		Numbers	
		Sample	Total	Sample	Total
3	Pacific ocean perch	136	1197	411	3617
3	Rex sole	45	365	198	1606
3	Dover sole	57	160	85	239
4	Euchalon	5	160	169	6009
5	Pacific ocean perch	79	152	299	575
6	Pacific ocean perch	120	667	332	1845
8	English sole	130	251	543	1048
23	Sandlance	2	3	108	216
40	English sole	84	270	360	1157
44	Walleye pollock	35	78	204	455
49	Arrowtooth flounder	197	276	221	310
73	Ratfish	175	365	220	459
73	Arrowtooth flounder	283	784	248	687
74	Walleye pollock	85	297	493	1723
76	Dover sole	87	251	232	669
76	Rex sole	56	85	256	389
79	Dogfish	226	663	157	460
81	English sole	45	461	316	3237
82	Arrowtooth flounder	238	489	240	493
82	Dover sole	284	475	403	674
82	Ratfish	96	328	347	1186
82	Rex sole	91	112	472	581
88	Pacific cod	241	1034	258	1107
88	English sole	84	195	754	1750
89	Arrowtooth flounder	792	265	272	813

Table 6. Length frequencies of Pacific cod and English sole sampled for ovaries during F/V Eastward Ho species assemblage survey of Hecate Strait, May 27–June 16, 1987.

Fork length (cm)	English sole		Pacific cod	
	No. immature	No. mature	No. immature	No. mature
20				
21	1			
22	3			
23	1			
24	1			
25	0			
26	0			
27	1			
28	5			
29	0			
30	0			
31	2			
32	0			
33	1	4	1	
34	1	4	0	
35		1	1	
36		5	2	
37		6	2	
38		2	8	
39		4	2	
40		7	0	
41		5	0	
42		3	0	
43		1	0	
44		1	1	
45		5	1	
46		3	0	
47		2	0	2
48		3	3	1
49		2	0	3
50		2	3	2
51		1	2	1
52		0	0	0
53		2	1	0
54			0	4
55			0	2
56			1	3
57				1
58				1
59				2
60				1
61				1
62				2
63				3
64				1
65				0
66				1
67				0
68				1
69				0
70				2
71				1
72				0
73				1
74				0
75				1
Total	16	63	28	37

Table 7.

Haul	14	15	Total	33	34	Total	44	45	Total	60	64	Total	Total
Trophic area	B	B	B	D	D	D	C	C	C	A	A	A	
Block	F2	F2		I4	I4		H4	H4		B2-5	B2		
Depth stratum	1	1		4	4		6	7		5	5		
Arrowtooth flounder	-	-	-	-	-	-	2	4	6	39	5	44	50
Dover sole	-	-	-	-	-	-	-	30	30	-	20	20	50
English sole	-	-	-	33	23	56	14	20	34	21	1	22	112
Flathead sole	-	-	-	-	-	-	-	4	4	-	-	-	4
Pacific halibut	-	3	3	-	1	1	-	-	-	2	12	14	18
Pacific sanddab	-	-	-	13	13	26	-	-	-	-	-	-	26
Petrale sole	-	-	-	-	-	-	-	3	3	-	-	-	3
Rex sole	-	-	-	10	10	20	10	20	30	17	-	17	67
Rock sole	16	2	18	-	-	-	-	-	-	-	-	-	18
Sand sole	3	-	3	-	-	-	-	-	-	-	-	-	3
Sebastes alutus	-	-	-	-	-	-	-	10	10	-	-	-	10
S. babcocki	-	-	-	-	-	-	-	3	3	-	-	-	3
S. brevispinus	-	-	-	-	-	-	-	1	1	-	-	-	1
S. flavidus	-	-	-	-	-	-	-	1	1	-	-	-	1
Lingcod	-	-	-	1	-	1	-	-	-	-	-	-	1
Pacific cod	3	25	28	-	-	-	28	26	54	2	-	2	84
Sablefish	-	-	-	-	-	-	1	-	1	2	4	6	7
Walleye pollock	-	-	-	-	-	-	20	12	32	-	-	-	32
Ratfish	-	-	-	10	1	11	18	9	27	-	20	20	58
Big skate	1	-	1	-	-	-	-	-	-	-	-	-	1
Black skate	-	-	-	-	-	-	-	-	-	2	-	2	2
Male spiny dogfish	1	1	2	-	-	-	-	-	-	-	-	-	2
Female spiny dogfish	21	12	33	2	2	4	5	1	6	5	4	9	52
Total	45	43	88	69	50	119	98	144	242	90	66	145	605

NET DIMENSIONS AND CHARACTERISTICS FOR BOTTOM TRAWL

VESSEL EASTWARD HO NET Yankee 36

OBSERVATION PERIOD May 27 - June 16, 1987

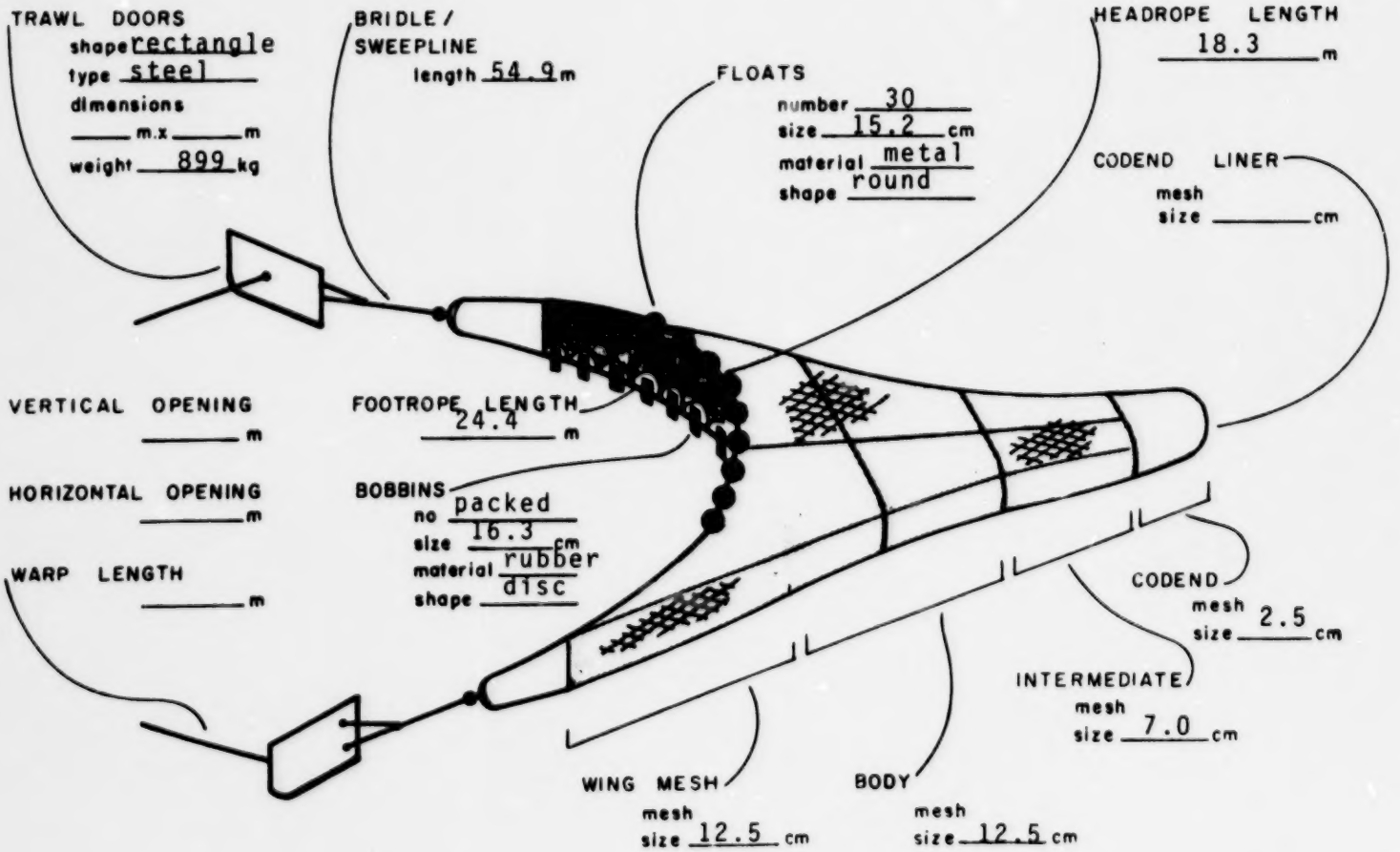

Fig. 1.

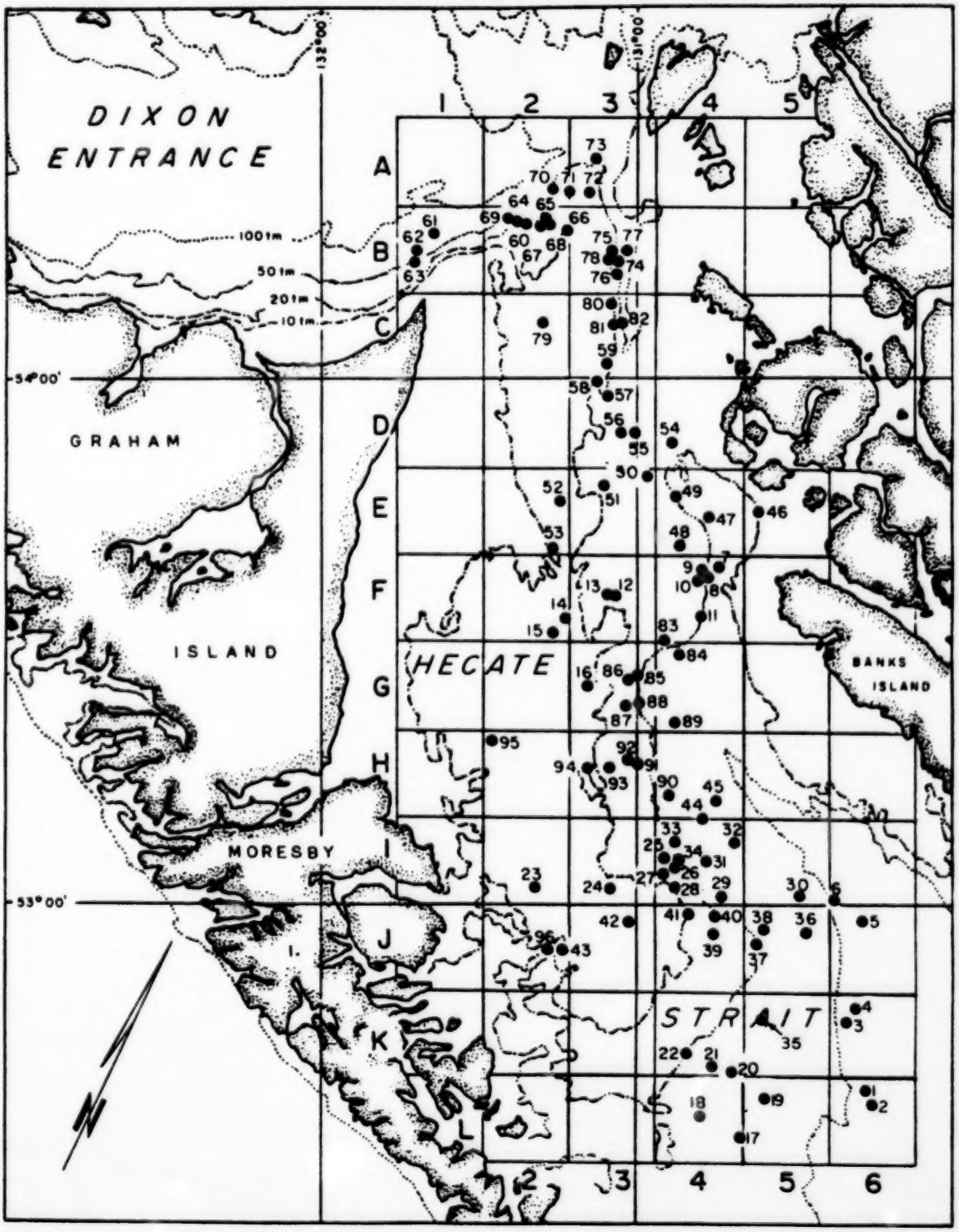

Fig. 2. Haul locations for F/V EASTWARD HO species assemblage survey of Hecate Strait, May 27 - June 16, 1987.

Appendix Table 1 through Appendix Table 6 do not appear in paper,
but appear in microfiche form at the back of this report.